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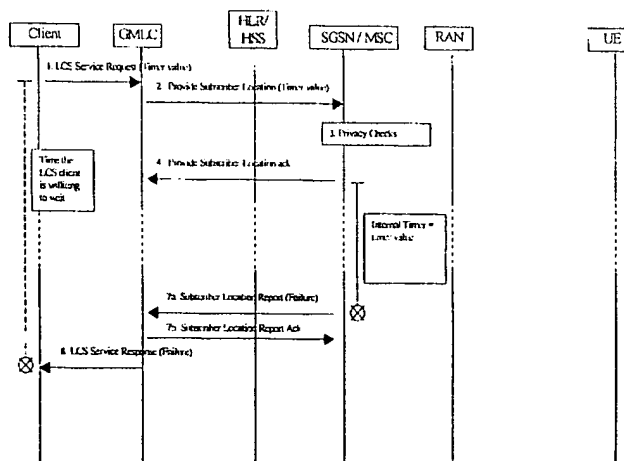
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For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.(54) Title: SYSTEM FOR IMPROVING THE HANDLING OF DEFERRED REQUESTS OF THE LOCATION OF A USER TER-
MINAL IN A MOBILE TELEPHONE SYSTEM

(57) Abstract: The invention related to a system for improving the handling of deferred requests of the location of a user equipment from a Location Service (LCS) client to a Location Service (LCS) server in a mobile telephone system, comprising a sender for sending, as a new parameter, a time gap within which the LCS client must receive the positioning information, to the mobile Service Switching Center (MSC), through the Gateway Mobile Location Center (GMLC); a receiver for receiving said new parameter at the Mobile Service Switching Center (MSC). The invention relates also to a method to carry out the above system, in which said time gap is sent as a new parameter specifying maximum amount of time that the LCS client waits for receiving back the location information and in that said new parameter is sent from the LCS client to MSC/SGSN via GMLC in the LCS request. It is preferred that said new parameter is sent from LCS client to GMLC and from this to MSC/SGSN modifying signalling messages already in use.

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"SYSTEM FOR IMPROVING THE HANDLING OF DEFERRED REQUESTS OF THE LOCATION OF A USER TERMINAL IN A MOBILE TELEPHONE SYSTEM"

* * * *

The present invention relates to a new system for improving the handling of deferred requests of the location of a user terminal in a mobile telephone system negotiating, between an LCS client and an LCS server (LCS=LoCation Services), the time gap relating to said deferred requests.

The invention can be applied to both GSM and UMTS technologies, and in the context of both Circuit Switched (CS) and Packeted Switch (PS).

The prior art concerning the mobile positioning systems, the way in which deferred requests of the location of a mobile user equipment are currently carried out and the new system and method to improve, according to the invention, the handling of said deferred requests, are illustrated in the attached drawings in which:

fig. 1 is a block diagram representing the standard architecture of a positioning system according to the state of the art;

fig. 2 is a diagram representing how the main signalling between nodes currently takes place in case of a deferred request of the location of a user equipment, in a mobile telephone system;

figs. 3 and 4 illustrate how the abort of the deferred location request currently takes place, due to expiring of the timer of MSC/SGSN; and

fig. 5 illustrates how the abort of the deferred location request takes place, due to expiring of the timer of MSC/SGSN, according to the invention, with negotiated timer value.

With reference to the attached drawings, Fig. 1 represents the standard architecture of a mobile positioning system.

The Gateway Mobile Location Center (GMLC) implements

functionalities required to support the LoCation Services LCS. In one network, there may be more than one GMLC. Each GMLC is the first node for the accesses of an external LCS client in a mobile network. GMLC may request routing information from a global register - Home Location Register (HLR) or Home Subscriber Server (HSS)- of the subscribers of the operator. Furthermore the GMLC contains information allowing to perform authentication and authorization activities of external LCS client entities requiring location of mobile users. After having obtained the routing information and performed the authorization and authentication activities of the external LCS clients, GMLC sends the location request to the Mobile Services Switching Center or to the Visitor Location Register (MSC/VLR) or to the Serving GPRS Support Node (SGSN) and receives information about the geographic coordinates of the mobile user terminal whose location has been requested from the corresponding entities.

The HLR/HSS register contains all subscription user data, including LCS subscription user data and routing information. For a roaming mobile subscriber, HLR/HSS may be in a different network from the one he is currently roaming into. In other words, should the user be roaming in the network of an operator different from the one he subscribes to, the HLR/HSS register is always the one of the operator the user subscribes to. The MSC/VLR or SGSN implements the functional activities for authorizing and handling location requests relating to the subscriber. The LCS functions of MSC/SGSN relate to charging and billing, coordination, location request and operation of LCS services.

The system provides the opportunity of requesting the location of the mobile user terminals from an external LCS client (Mobile Terminating Location Request=MT-LR), the location from the terminal itself (Mobile Originating Location Request=MO-LR) and the auto-induced location from

network (Network Induced-Location Request = NI-LR).

An LCS client can perform a deferred request of the location of a user terminal in a mobile system, i.e. he can request to be supplied with the current location coordinates of the mobile user, if immediately available, or the location coordinates of the user itself in a subsequent instant in which an event specified in the request takes place (e.g. when the user becomes available). How long the MSC/SGSN must wait before aborting the location procedure is not standard and depends on the implementation.

As an example, a deferred mobile terminal location request may be used to have subscriber location information when the subscriber becomes available after temporary loss of radio connectivity. Further events could also be defined in the future.

In fig. 2 of the attached drawings an overview is provided of the main signalling between nodes in case of a deferred location request for a user equipment in a mobile telephone system.

The LCS client sends a positioning request to the GMLC by means of LCS Service Request message, carrying, among the other information, the indication about the event which has to occur in order to perform positioning. The GMLC verifies the identity of the LCS client and its subscription to the LCS service. The GMLC derives the address of the SGSN/MSC currently visited by the User Equipment (UE) and sends a MAP PROVIDE_SUBSCRIBER_LOCATION message to the SGSN/MSC. This message transfers the received event to the SGSN/MSC. The SGSN/MSC authenticates the GMLC and performs privacy checks in order to verify if the LCS client is allowed to position the target UE. If Privacy Checks are successfully performed, the SGSN/MSC stores the received information and informs the GMLC that the deferred MT-LR has been accepted and is in process by means of MAP PROVIDE_SUBSCRIBER_LOCATION_ACK

message. When the requested event is detected in the SGSN/MSC, the location procedures are performed and the results are sent to the GMLC by means of MAP SUBSCRIBER_LOCATION_REPORT message. The GMLC acknowledges the reception of the information by means of MAP SUBSCRIBER_LOCATION_REPORT_ACK message and sends the results to the LCS client by means of LCS SERVICE_RESPONSE message.

The amount of time that the MSC/SGSN waits before aborting a deferred location procedure in a mobile system is implementation dependent. With the existing technology, in connection with which figs. 3 and 4 illustrate how the aborting of the deferred location request takes place due to expiring of the timer of MSC/SGSN, this center cannot know how long the LCS client is willing to wait for a deferred answer. A too short timer value in MSC/SGSN (fig. 3) will lead therefore to a premature abort of the deferred procedure, even if the LCS client is still willing to wait, with missing profits for the operator. On the other hand, a too long timer value in MSC/SGSN (fig. 4) will lead to a useless engagement of MSC/SGSN resources if the LCS client is no more interested in having the location information and cannot abort the deferred procedure due to any fault in the LCS client or in GMLC or in the links between the LCS client itself and GMLC and/or between GMLC and MSC/SGSN, during the ongoing deferred location request processing.

With the present invention, the above mentioned problems are overcome by providing a mechanism to let MSC/SGSN know the amount of time that the LCS client is willing to wait for the answer to a deferred location request in a mobile system. The invention implies employing a new parameter that the LCS client has to send to MSC/SGSN via GMLC, in order to specify the value for the timer in MSC/SGSN.

More precisely, the invention relates to a system for improving the

handling of deferred requests of the location of a user equipment from a Location Service LCS client to a Location Service LCS server in a mobile telephone system, characterized in that it comprises:

- a sender for sending, as a new parameter, a time gap within which the LCS client must receive the positioning information, to the Mobile Service Switching Center MSC, through the Gateway Mobile Location Center GMLC;
- a receiver for receiving said new parameter at the Mobile Service Switching Center MSC.

The invention relates also to a method to carry out a system as above characterized in that said time gap is sent as a new parameter, specifying the maximum amount of time that the LCS client waits for receiving back the location information and in that said new parameter is sent from the LCS client to MSC/SGSN via GMLC in the LCS request. In this method said new parameter is sent from the LCS client to GMLC and from this to MSC/SGSN modifying signalling messages already in use.

The invention will be now described in detail with particular reference to Fig. 5 of the attached drawings.

According to the invention, a new parameter specifying the amount of time that the LCS client is willing to wait for the location information, which is application dependent, is sent from the LCS client to GMLC in the LCS request. This parameter is sent from GMLC to MSC/SGSN through a MAP (=Mobile Application Part) message "PROVIDE-SUBSCRIBER-LOCATION". When the acknowledgment message "PROVIDE-SUBSCRIBER-LOCATION-ACK" is sent back to GMLC, MSC/SGSN starts a timer according to the value received in the request. If this timer expires, the message "SUBSCRIBER LOCATION REPORT" is sent back, as in the existing procedure.

The main signalling and the way in which, according to the invention, the abort of the deferred location request takes place, due to expiring of the timer of MSC/SGSN - with negotiated timer value - are clearly illustrated in the diagram of fig. 5.

Two examples are useful for the best understanding of the invention.

Example 1

The LCS client is willing to receive the answer by $T=30$ minutes. The existing implementation dependent timer in the MSC/SGSN is set to 5 minutes. The UE becomes available 10 minutes after the LCS client positioning request.

Problems with the existing technology

According to the existing technology, the LCS client sends the request for the deferred location procedure to the MSC/SGSN. After 5 minutes the MSC/SGSN aborts the procedure and sends a failure message to the LCS Client. The positioning procedure is unsuccessful and the operator cannot charge the procedure that means missing gain for the operator.

Benefit of the invention

According to the improvements given by the invention, the LCS client gives to the MSC/SGSN (via GMLC) the indication that he is willing to receive the answer by 30 minutes. The MSC/SGSN receives the information and starts its internal timer according to the received indication (30 minutes). 10 minutes later, the UE becomes available, the positioning is performed and the response is sent to the LCS client via GMLC. The operator can charge the procedure, as it was successful.

Example 2

The LCS client is willing to receive the answer by $T=10$ minutes. The existing implementation dependent timer in the MSC/SGSN is set to 60

minutes. Five minutes after that the LCS client sends the positioning request, a fault occurs in the GMLC. The UE does not become available.

Problem with the existing technology

According to the existing technology the positioning request is received in the MSC/SGSN, the needed resources are engaged and the implementation dependent timer is started (60 minutes). Ten minutes later, the LCS client internal timer expires and the LCS client tries to cancel the ongoing deferred location request. Due to a temporary fault in the GMLC, the MSC/SGSN does not receive any indication about the cancellation request, so that the MSC/SGSN resources remain engaged until the MSC/SGSN timer expires. The engagement is not useful for 50 minutes: if the UE becomes reachable after that the LCS client internal timer expires, the LCS client would ignore the positioning response.

Benefit of the invention

According to the improvements given by the invention, the LCS clients gives to the MSC/SGSN (via GMLC) the indication that he is willing to receive the answer by 10 minutes. The MSC/SGSN receives the information and starts its internal timer according to the received indication (10 minutes). When the timer expires, the MSC/SGSN releases all its involved resources.

The improvement and the advantages attained with the present invention are clearly apparent: the system embodying its subject matter prevents in fact the operator and service providers from missing gains due to early interruption of the deferred location requests and prevents an useless engagement of resources in case of problems in the connections between the LCS client and GMLC and/or between GMLC and MSC/SGSN.

The invention comprises also a computer program loadable on a memory, adapted to perform the steps of the method according to the

invention itself.

CLAIMS

1) A system for improving the handling of deferred requests of the location of a user equipment from a Location Service (LCS) client to a Location Service (LCS) server in a mobile telephone system, characterized in that it comprises:

- a sender for sending, as a new parameter, a time gap within which the LCS client must receive the positioning information, to the mobile Service Switching Center (MSC), through the Gateway Mobile Location Center (GMLC);
- a receiver for receiving said new parameter at the Mobile Service Switching Center (MSC).

2) A method to carry out a system as in claim 1) characterized in that said time gap is sent as a new parameter specifying the maximum amount of time that the LCS client waits for receiving back the location information and in that said new parameter is sent from the LCS client to MSC/SGSN via GMLC in the LCS request.

3) A method according to claim 2), in which said new parameter is sent from LSC client to GMLC and from this to MSC/SGSN modifying signalling messages already in use.

4) A method according to claim 3), in which, when an acknowledgement message "PROVIDE-SUBSCRIBER-LOCATION-ACK" is sent to GMLC, MSC/SGSN starts a timer according to the time value in the request, a message "SUBSCRIBER LOCATION REPORT" being sent to GMLC according to the existing procedure.

5) Computer program loadable on a memory adapted to perform the steps of the method as in claims 2) to 4).

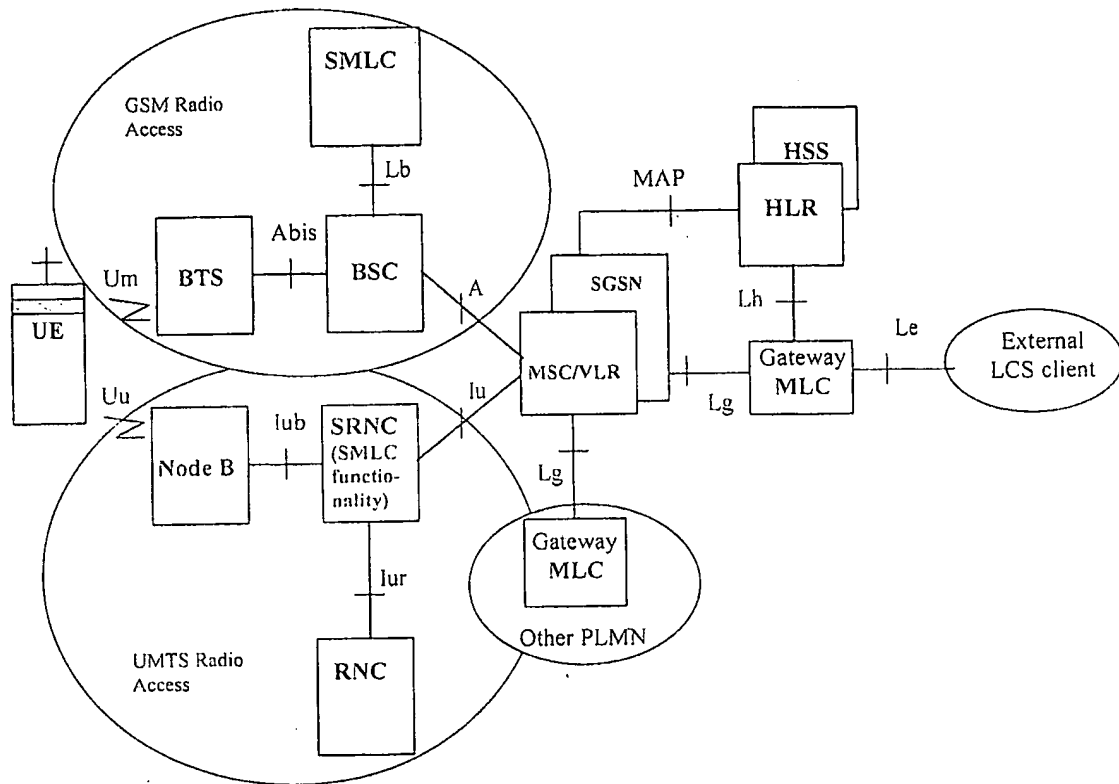


FIG. 1

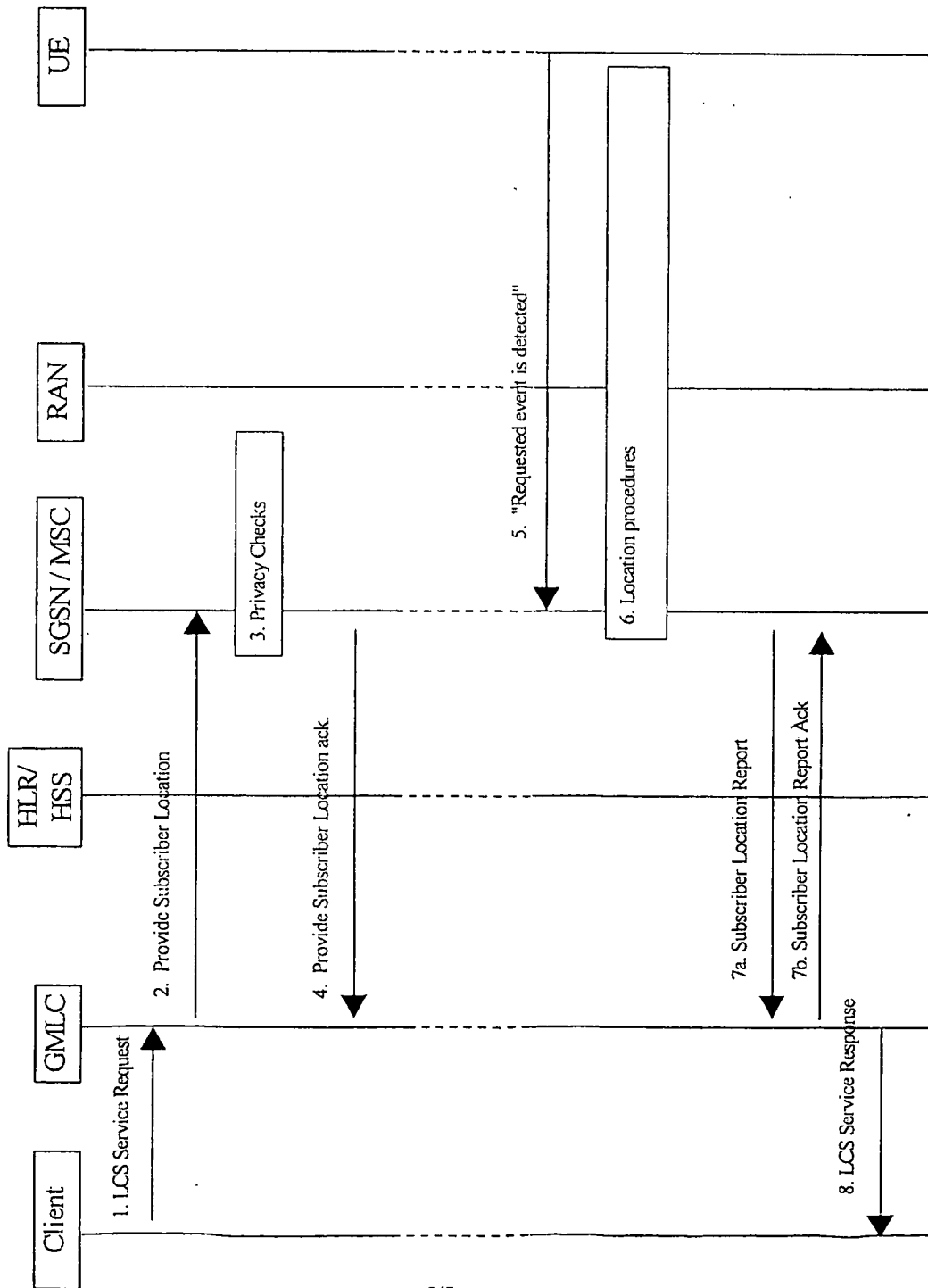


FIG. 2

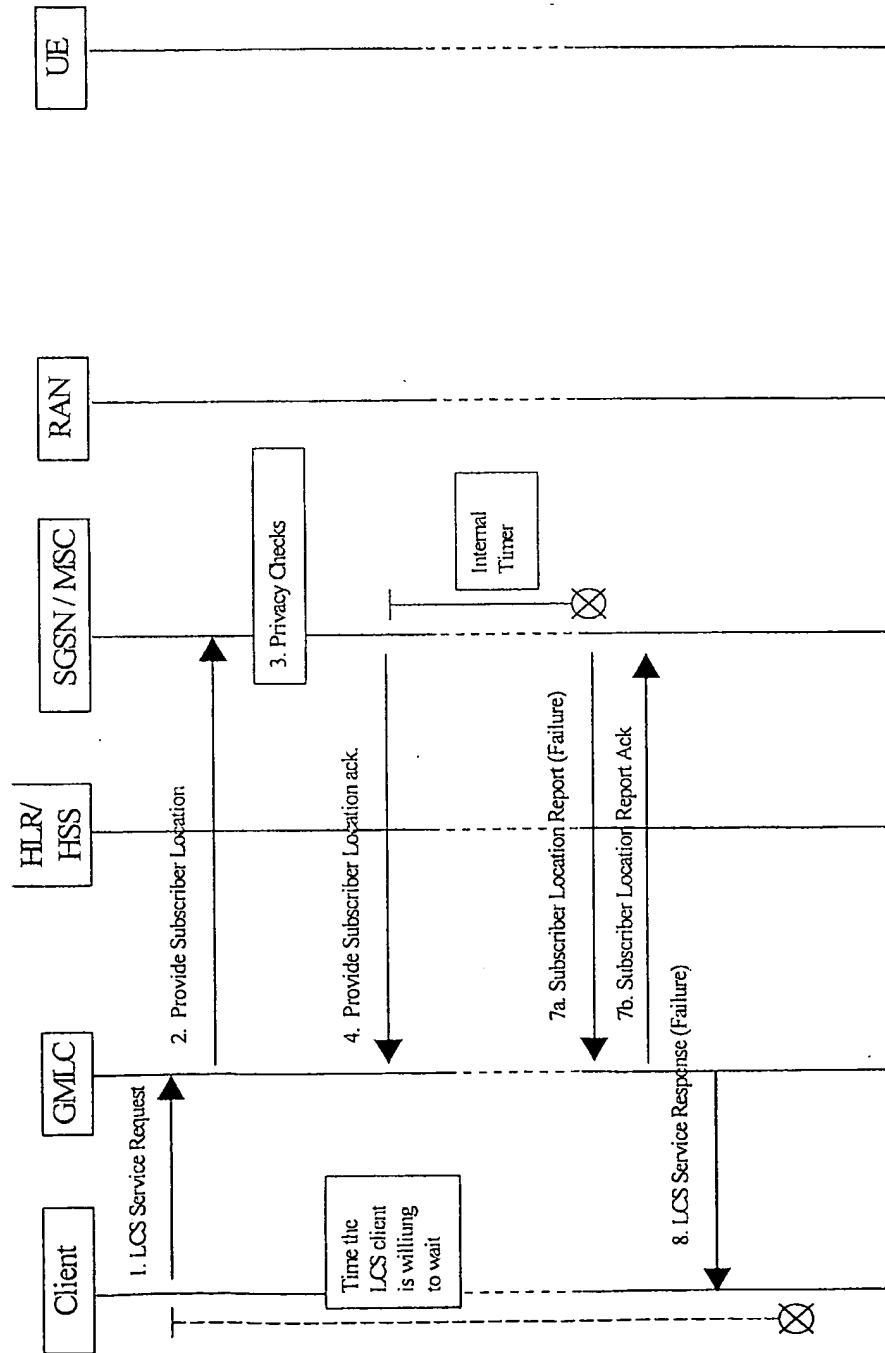


FIG. 3

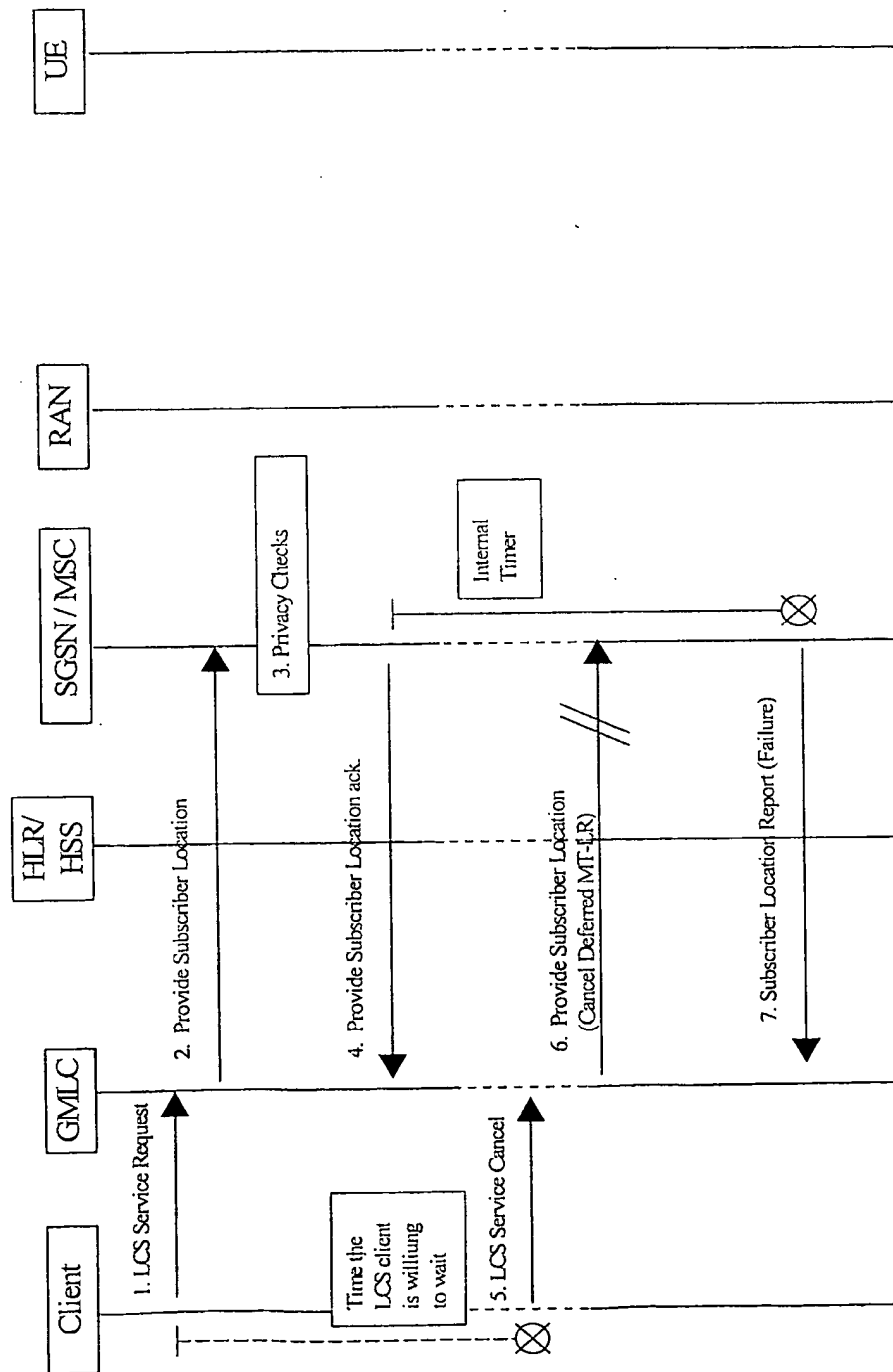


FIG. 4

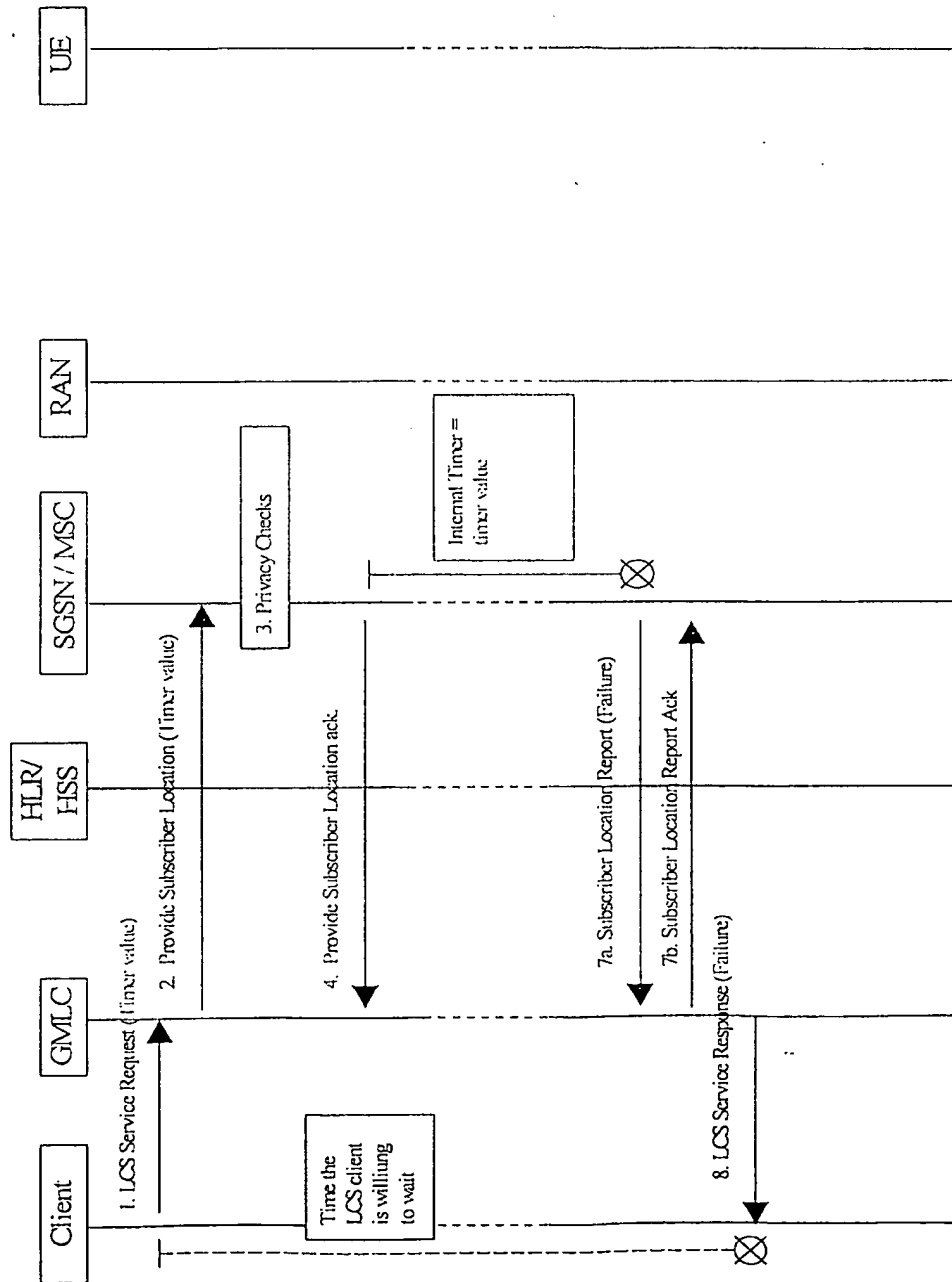


FIG. 5

INTERNATIONAL SEARCH REPORT

International Application No.

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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>"Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); Functional stage 2 description of location services (3GPP TS 23.271 version 4.4.0 Release 4); ETSI TS 123 271 V4.4.0 (2001-12)"</p> <p>ETSI TS 123271 V4.4.0, 'Online! December 2001 (2001-12), pages 16-26, 44-46, 62, XP002208109</p> <p>Retrieved from the Internet: <URL:http://WEBAPP.ETSI.ORG/exchangefolder/ts_123271v040400p.pdf> 'retrieved on 2002-07-30!</p> <p>page 20, paragraph 5.5.1 -page 21, paragraph 5.5.2 page 46, paragraph 9.1.8.3; table 10.6 figures 6.1, 9.6A, 9.6B</p> <p style="text-align: center;">--- -/--</p>	1-5

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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INTERNATIONAL SEARCH REPORT

ational Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>"Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); Location Services (LCS); Service description, Stage 1 (3GPP TS 22.071 version 4.3.0 Release 4); ETSI TS 122 071 V4.3.0 (2001-03)" ETSI TS 122 071 V4.3.0, 'Online! March 2001 (2001-03), pages 19-22, XP002208110 Retrieved from the Internet: <URL:http://WEBAPP.ETSI.ORG/exchangefolder/ts_122071v040300p.pdf> 'retrieved on 2002-07-30! page 21, paragraph 5.3.1.1 table 1</p>	1-5
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
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